participating systems, the risk of failure is lowered. Many utilities, for example, have interconnections with neighboring systems for the sole purpose of supplying or receiving water during emergency situations, including contamination of one system's water supply or in times of short-term supply concerns. Interconnections, especially emergency interconnections, are relatively common, as seen in this map of water system interconnections in 2002 in North Carolina's Central Coastal Plain.

Excess capacity usually exists because new treatment plants and reservoirs are designed with capacities that anticipate growth over several decades, and these systems are therefore underutilized when they first come online. Interconnects allow new systems to be more fully utilized while delaying the need for large capital projects for older utilities that are purchasing finished water.

If interconnects are to become more common, utilities must become more comfortable with creating transfer agreements that determine the timing and volume of transfers. Transfer "triggers" can be constructed to reduce risk to the buyer and seller, but a very low-risk tolerance can reduce the benefits of the interconnect. Transfer contracts can include the use of low-risk thresholds for triggering transfers, thereby reducing the probability of a buyer shortfall; seasonal restrictions on transfers, which might reduce the seller's responsibility to transfer water during its peak demand months (i.e., summer); limits on transfer volume, which act to ensure reliability for the seller's own customers; and rules for sharing the seller's available treatment/conveyance capacity among multiple buyers.

Interconnects can also require an interbasin transfer permit if the utilities have customers in different river basins and the volume of possible transfers exceeds 2 mgd.

Case Study

Caldwell and Characklis (2008) analyzed inter-utility transfer agreements that would allow three Triangle utilities (Cary/Apex, Durham, and the Orange Water and Sewer Authority (OWASA)) to meet their future demands in the face of regional growth. The transfer agreements developed in this work would allow Durham and OWASA to meet dry year demands in the short- and medium-term by taking advantage of their existing Jordan Lake allocations through the Cary/Apex systems, even as they undertake long-term plans to develop new water supplies.

The analysis involves moving beyond consideration of the minimum-cost scenarios and toward the types of transfer agreements that the utilities felt would be more likely to be implemented because they include different types of conditional limits on when and how much water can be transferred. Within this framework, the objectives of the study were to conduct an in-depth analysis of the volume, frequency, and timing of transfers expected under specified scenarios and to provide estimates of the costs associated with any particular transfer agreement.

With respect to the agreement types considered, results show that over an eighteen-year simulation period (which includes two of the most severe droughts on record) transfers could successfully assist the participating utilities in meeting future demands. Depending on the utility and the risk-reduction mechanisms in place, transfers only occur between one and six years over the eighteen-year simulation period. The integration of various risk-reduction mechanisms into the transfer